AMSAT SATELLITE REPORT

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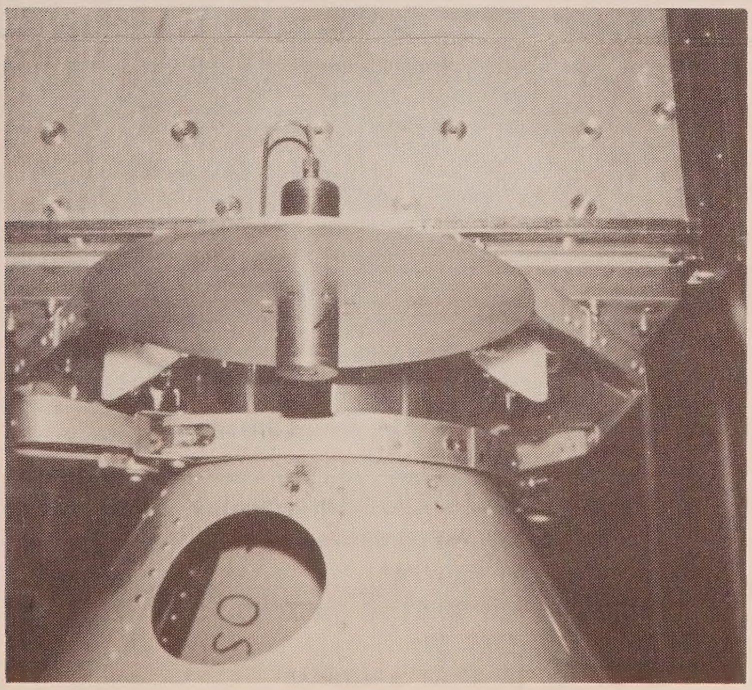
OSCAR 9 Is Born

The week of 4 Oct. 81 was a very special one in the annals of Amateur Radio for it was during that week that a new OSCAR was born! Dubbed "UoSAT OSCAR 9" or UO-9, the product of the labors of technicians at the University of Surrey, Guildford, England, and a consortium of assisting satellite groups around the world, came to life on the morning of 6 Oct. 81.

To be certain there were a few difficult moments after the first few orbits, but at press-time many of the residual concern areas had yielded to clever solution and but a few problems remained.

This issue of *ASR* will again feature in its "Spotlight" column another fraction of the technical specifications of UO-9. This week we will focus on the telemetry and status point format. Other features will highlight UO-9 through its first week of life, present the orbital parameters as known at press-time and describe in brief the problems which lie ahead along with the general operations scheme.

In the last two full decades, the world's amateurs have averaged a successful satellite launch on the average of once every 27 months or so. That makes the week of 4 Oct. 81 very special indeed!



UoSAT 10-GHz slotted Helix antenna details.

OSCAR 9 First Week A Bumpy Road

Though the launch of UoSAT OSCAR 9 was an emminent success, mental "red flags" were raised within hours of launch when the new OSCAR failed to respond readily to commands issued from the primary ground command station at Surrey and from the back-up station at the AMSAT OSCAR Spacecraft Laboratory at the Goddard Space Flight Center. Though the 2 meter beacon was heard promptly upon command when UO-9 was first within view of Surrey, the telemetry format was definitely not what was expected. Instead of the 1200 baud, ASCII telemetry that was commanded, what UO-9 yielded was an unintelligible garble occasionally modulating the very strong carrier. Reports of reception of the 2 meter beacon came almost immediately from Marburg, West Germany from AMSAT-DL President DJ4ZC. Shortly thereafter, KL7GRF/W6 in Southern California reported AOS with phenomenally strong signals on 145.825 MHz. But both reported just a steady unmodulated carrier. After several days of attempts to command the new spacecraft into various modes, Surrey was successful late in the week in getting UO-9 into the 1200 baud mode by using the 70 cm command channel. The only problem was that instead of coming on in the 1200 baud *synchronous* ASCII mode, the ornery new bird came on in *asynchronous* mode which rendered most of the resultant deluge of telemetry unusable. Finally, on Friday 9 Oct., G3YJO's staff was able to command UO-9 to the 300 baud ASCII mode. At that time dozens of keenly interested amateurs around the world obtained their first glimpse at the health and welfare of the fledgling.

The 300 baud ASCII was spewing out of printers and cascading across CRT faces as fast as one could read it. And what it said, while all very absorbing, was both positive and negative as far as the nominal mission profile was concerned. On the positive side, all of the hardware seemed to have survived the launch well. However, the spacecraft was considerably colder than desired and there was no output from two of the three navigation magnetometer channels. It was suggested that there likely was a connection in that the magnetometer oscillators might be out of their operating regime by virtue of being too cold. By press-time the nav-mags had not yet come on and that complicated the early stages of the mission by requiring extensive accumulation of other telemetry

and careful analysis to determine the attitude and spin rates of the satellite. The nav-mag's main function is to provide data on the orientation and rate of spin of the spacecraft with respect to the geomagnetic field. Once the attitude and spin rates are known, attitude adjustment and despin using the torquing electromagnets would commence. Later still, the gravity gradient boom would be deployed to further stabilize the platform for the long-term. With the anomalistic performance of the nav mags to date, the entire course of operations must be postponed. If, as assumed, the nav mags failure to date is, in fact, because of being too cold, then the course would seem to be to use other data, such as that from the solar cell current sensors, to determine the orientation of UO-9. Though neither Surrey nor AMSAT-UK has formally announced an operational plan an AMSAT Official contacted by *ASR* in Washington indicated that it would likely be a month or so until things had settled down enough to contemplate activating the onboard experiments. "In any case," this Official commented, "UO-9 is under the direct control of Surrey and G3YJO with others in a supporting role only, should we be called upon to help."

Temperatures aboard UO-9 were reported to vary, according to sensor location and position of the spacecraft on orbit from about *−5°C* to less than *−30°C* (*23°F* to *−22°F*).

Midwest Division Convention Draws Satellite Interest

Several dozen enthusiastic AMSAT members and satellite enthusiasts gathered in Salina, Kansas October 3 and 4 for the 1981 Midwest Division ARRL Convention, actively promoted by AMSAT Net Control staion WØCY. According to Jim, the group of loyal AMSAT members started the convention off ahead of time with an informal dinner/"attitude adjustment" meeting on Friday, and jointly presented various aspects of the Amateur Satellite Program to an attentive crowd of over 100 at the Saturday Forum. WØCY gave his superb presentation, aided with visual aids courtesy of W3IWI. Bill, KØRZ explained his technique for using the Apple II microcomputer as a satellite-tracking system, and the level of interest in satellite activity was reported as very good, this in part to the planned coverage of the since-rescheduled UoSAT launch over the Salina 2 meter repeater.

Among the notables attending were WØVO, WØCA, WØZWW, WB5MPU, WØCUV, KØSMI, KØRZ, WBØIUT, WØRQY, WØKL, and others.

New Award Possible?

ASR Contributing Editor KEØT claims the first AMSAT-Murphy "Exploding-Cigar" Antenna Award to commemorate this example of perversity. What used to be a fiberglass 2 meter vertical turned into what you see when struck by a bolt of mother nature's finest early this summer. Bob says the only damage that wasn't insured was to his nerves, as he now practices grounding the antenna farm, even when the sun is shining!

UoSAT OSCAR 9 Orbit Data Told

Reaching for the heavens from the cool California coast 6 Oct. was a Delta rocket bearing the fruits of the labor of hundreds of individuals who contributed to the two payloads aboard: Solar Mesopheric Explorer (SME) and UoSAT OSCAR 9 (UO-9).

The launch was letter perfect from start to finish with all milestones passed exactly as portrayed on the mission time-line. Liftoff from Vandenberg AFB was at precisely 11:27:00.7 or within 700 milliseconds of launch window opening. At T plus about 3000 seconds after a series of engines shutdowns, coasts phases, engine restarts and final shutdowns, it was apparent to all that the Delta had again performed its function in an absolutely perfect manner. At press-time the following set of orbital elements were made available by AMSAT from Offical U.S. Government sources.

For object 1981-100B (UoSAT OSCAR 9)
Reference epoch: 1981 281.24182346
Inclination: 97.4631°
RAAN: 243.6917°
Eccentricity: 0.0001393
Arguement of Perigee: 317.2501°
Mean Anomaly: 42.8824 (at the reference epoch)
Mean Motion: 15.09449339 orbits per day

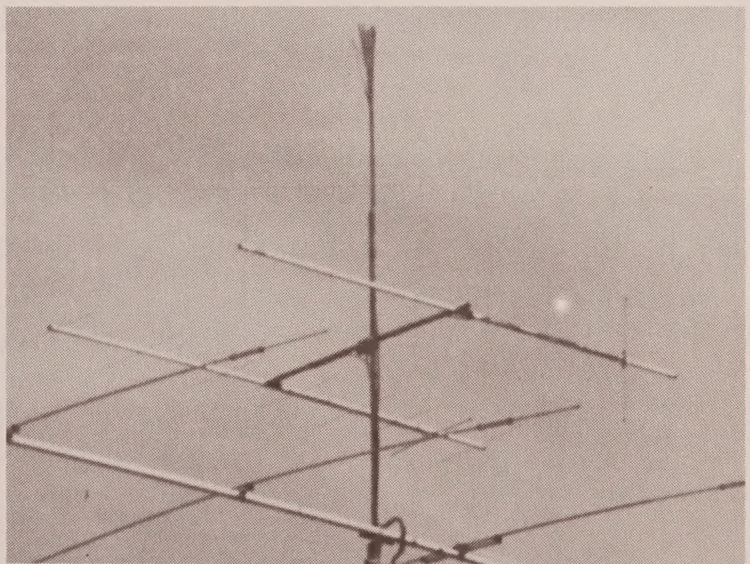
From the classic Keplerian elements given above, the following derived valued may be obtained:

Period: 1.59133213 hours (95 minutes, 28.796 seconds, approx.)

Longitude Increment: 23.86563° West per orbit

Perigee height: 533 km (331.2 miles) over standard Earth

Apogee height: 536 km (331.1 miles) over standard Earth



The Exploding-Cigar. See "New Award Possible."

Reference Oribt for UO-9 for Tuesday, 20 Oct. 81:
Orbit No. 205 00:59:40 148.2°W
Wednesday, 21 Oct. 81:
Orbit No. 220 00:51:50 146.2°W
Thursday, 22 Oct. 81:
Orbit 326 01:30:31 156.0°W

ASR Spotlight on: UoSAT

(Continued from ASRs 16 and 17)

Telemetry Sensor Allocation

Channel	Parameter	Range	Cal. Equation
00	Secondary S/C Computer (F100L)	0 -1A	I= 1.2N mA ($0.125A<I<1A$)
01	Solar Array Current +X	0 - 2A	I= 1.12N+200(for Is less than 200 mA)
02	Battery Half Voltage	0 - 10V	V= N/100 *(1.01)
03	Radiation Detector A O/P	0 - 5V	Count= 40N *(1.04)
04	Radiation Detector B O/P	0 - 5V	Count= 40N *(1.04)
05	Magnetometer Expt. HX-Coarse	0 - 5V	V= N/200 *(1.01)
06	Magnetometer Expt. HY-Coarse	0 - 5V	V= N/200 *(1.01)
07	Magnetometer Expt. HZ-Coarse	0 - 5V	V= N/200 *(1.01)
08	Battery Pack-A Temperature	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
09	Spacecraft Facet Temperature +X	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
10	Visual Display Expt. & CCD Current	0 - 1A	I= 1.2*(N−30 mA ($0.15A<I<1a$)
11	Solar Array Current +Y	0 - 2A	I= 1.12N+200(for Is less than 200 mA)
12	2.4 GHz Beacon Expt. Power O/P	0 - 2000mW	P= (N−99)*0.633 mW
13	Radiation Detectors Expt. EHT Volts	0 - 1000V	V= N volts
14	Radiation Detectors Expt. Current	0 - 250 mA	I= (N+20)/8 *(0.983) mA
15	Magnetometer Expt HX-Fine	0 - 5V	V= N/200 *(1.01)
16	Magnetometer Expt. HY-Fine	0 - 5V	V= N/200 *(1.01)
17	Magnetometer Expt. HZ-Fine	0 - 5V	V= N/200 *(1.01)
18	Battery Pack-B Temperature	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
19	Spacecraft Facet Temperature −X	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
20	Spacecraft Computer Current	0 - 1A	I= 1.2*(N−25) mA ($0.125A<I<1A$)
21	Solar Array Current −X	0 - 2A	I= 1.12N+200(for Is less than 200 mA)
22	Battery/BCR +14V Bus	0 - 20V	V= N/50 *(1.056)
23	Sun Sensor +Z Axis	0 - 5V	V= N/200 *(1.01)
24	10.4 GHz Beacon Expt. Current	0 - 250 mA	(N−40)/4 * 0.97
25	Magnetometer Expt. Temperature	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
26	Magnetometer Expt. Current	0 - 250 mA	(N/8)*0.9945
27	Telecommand Receiver Current	0 - 250 mA	I= (N−16)/8 *(0.952) mA
28	Module Box Assy. Temperature +X1	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
29	Spacecraft Facet Temperature +Y	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
30	Battery Charge Current	0 to +5A	I= 3N mA
31	Solar Array Current −Y	0 - 2A	I=1.12N+200(for Is less than 200 mA)
32	Power Conditioning Module +10V	0 - 20V	V= N/60 *(0.93)
33	Telemetry System Current	0 - 20 mA	I= (N−16)/30 *(1.084) mA
34	2.4 GHz Beacon Expt. Current	0 - 250 mA	I= 0.4*(N−11) *(1.072) mA
35	145 MHz Data Beacon Power O/P	0 - 2000mW	P= (N−82)*1.67
36	145 MHz Data Beacon Current	0 - 250 mA	I= (N−7)/4 * 1.014
37	145 MHz Data Beacon Temperature	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
38	Module Box Assy. Temperature −X1	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
39	Spacecraft Facet Temperature −Y	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
40	+14V Line Current	0 - 5A	I= 2.86N mA
41	+5V Line Current	0 - 5A	I= 1.28(N−50) mA ($0.075A<I<1A$)
42	Power Conditioning Module +5V	0 - 10V	V= 2N/300 *(1.12)
43	Sun Sensor −Z Axis	0 - 5V	V= N/200 *(1.01)
44	HF Beacons Expt. Current	0 - 250 mA	I= (N−36)/3 *1.038 mA
45	435 MHz Data Beacon Power O/P	0 - 2000mW	P= (N−102)*1.792
46	435 MHz Data Beacon Current	0 - 250 mA	I= (N−34)/3 *1.053 mA
47	435 MHz Beacon Temperature	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
48	Module Box Assy. Temperature +Y1	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
49	Spacecraft Facet Temperature +Z	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
50	+10V Line Current	0 - 5A	I= 3N mA
51	−10V Line Current	0 - 5A	I= 1.3*(N−60) mA
52	Power Conditioning Module −10V	0 - −20V	V= 0.0158N - 0.0224'N'('N' of +10v line)
53	Naviagation Magnetometer X-Axis	0 - 5V	V= N/200 *(1.01)†
54	Navigation Magnetometer Y-Axis	0 - 5V	V= N/200 *(1.01)†
55	Navigation Magnetometer Z-Axis	0 - 5V	V= N/200 *(1.01)†
56	Speech Synthesiser Current	0 - 250 mA	I= (N-16)/10 *1.009 mA
57	CCD Imager Temperature	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
58	Module Box Assy. Temperature −Y1	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C
59	Spacecraft Facet Temperature −Z	−30 to +50°C	Temp= (474−N)/5 *(1.01) Degrees C

†Determine vector as follows: $B_z = -189.54*(N_y - 336.55)$ $B_y = +183.486*N_x - 663.44$ $B_x = -194.5*(N_z - 496.5)$

$$B_t = \sqrt{(B_x^2 + B_y^2 + B_z^2)}$$

Silent Key

It is with deepest regret that we report the passing of one of the world's most prominent, well-liked and respected amateurs. Roy Stevens, G2BVN, became a Silent Key 30 Sept. after a long illness. Most recently he had served as IARU Region I Secretary and had been instrumental in attaining many of the major victories for Amateur Radio at WARC-79. Roy was also previously RSGB President and counted among his close friends most of the leaders of the world Amateur Radio community. He was especially enthusiastic about the Amateur Space Program and was a strong supporter of UoSAT, England's first Amateur Radio Satellite. It is ironic that Roy's passing should have come virtually on the eve of this long-held dream, the launch of UoSAT-OSCAR 9. Gone but not forgotten.

ALINS Tells the World

In the most successful operation of its kind in anyone's recollection, the AMSAT Launch Information Network/Service transmitted the launch countdown sequence from the Control Center at the Goddard Space Flight Center, Greenbelt, Maryland, through a continent-wide amateur HF/VHF network which ultimately virtually blanketed the world with UoSAT coverage.

With the late addition of the ARRL station W1AW from Newington, Connecticut, the HF/VHF net provided real-time coverage throughout the two critical hours from just prior to launch to just after reports of the first AOS. Feedback from field stations responding to ALINS stations polls indicated listeners as dispersed as Kiev (Soviet Union) and Ascension Island, Transkei and Brisbane. Reception in the primary coverage area of Europe was reported excellent via both the primary ALINS originated in the U.S. and the secondary source originated by AMSAT-UK on 80 and 40 meters. Repeaters around the globe also reported to local groups by retransmissions of the HF materials. AMSAT especially wishes to acknowledge the participation of all those staffing the ALINS facilities including (by name and location):

Bernie Glassmeyer and staff at W1AW
Richard Zwirko and Andy Zwirko at WA3NAN
Tom Geiger and crew at WA2CLV/6 (Vandenberg AFB)
Jim Lumsden and crew at W6VIO
Molly and Gordon Hardman at W3ZM
Art Feller at K3DML
Bill Tynan and crew at W3VD

A special debt of thanks is owed by all listening to Tom Clark, W3IWI, for the splendid blow-by-blow description and to Bob Ruedsuelli, W4OWA, for establishing the landline interconnects that was at the heart of ALINS. Bob, an employee of AT&T, arranged with the Long Lines Division to provide the special conferencing bridges on an experimental basis. The audio quality was excellent and totally amplitude equalized despite the dozen or so taps that existed to this new AT&T service. Thanks to all on behalf of all those who listened attentively that morning a couple of weeks ago!

AMSAT-OSCAR 7 Reports

In *ASR* #14 we reported that AO-7 had been sighted recently by a few amateurs around the world. Among them was Jack Ward, G4JJ. In a recent letter to *ASR*, Jack points out that the report of his reception of AO-7 was somewhat overstated. Whereas *ASR* reported Jack as having heard "good" signals from AO-7 on 8 Aug. 81, in fact, Jack now relates, the reception was extremely poor and he could not even definitely establish the source with certainty. What led him to suspect AO-7 was the Doppler effect and the time/frequency of the observation. Apparently *ASR's* Editor had a degree of difficulty in receiving the relay of Jack's observation report commensurate with Jack's own difficulty in hearing AO-7. *ASR* appreciates the clear channel virtues of written communications. Thanks Jack!

Next Ariane Launch Slated

ESA, The European Space Agency, has announced that LO4, the fourth and final test launch of the Ariane rocket, will take place on December 14, 1981. As with the prior three tests, number four will originate at the ESA facility at Kourou, French Guiana. AMSAT's Phase IIIA satellite was aboard the ill-fated LO2 mission which developed an engine malfunction and shortly thereafter ingraciously deposited Phase IIIA and the Firewheel (primary payload) on the Atlantic floor. The first and third Ariane tests were successful on 24 Dec. 79 and 19 June 81, respectively. Should the LO4 mission prove successful, the Ariane will enter its operational phase with L5 and begin its real competition for payload revenues with NASA's Space Transportation System (STS) or the "Shuttle" as it is popularly known.

In a written communication to AMSAT from ESA Headquarters, ESA Director General Erik Quistgaard indicated that Phase IIIB would ride with European Communications Satellite I (ECS I). Subsequent information from ESA points to early October 82 as the launch window center for Phase IIIB. The technical and management progress on Phase IIIB continues to be excellent and morale is very high in all participating work centers. Details on recent Phase IIIB progress in future *ASRs*.

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